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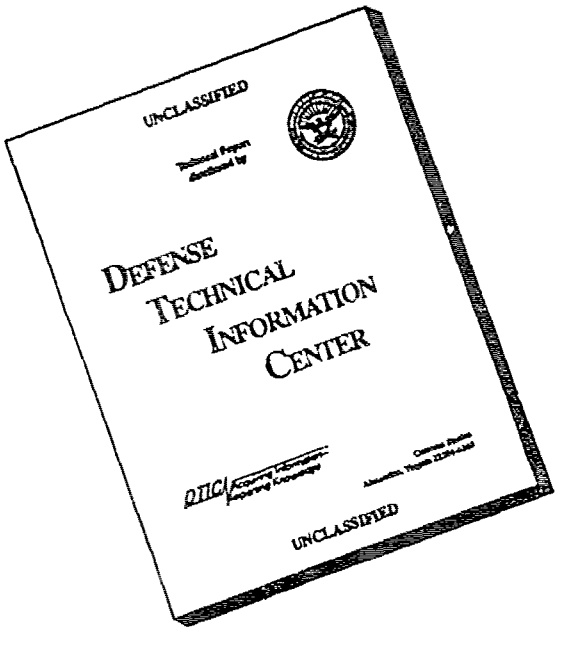

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Research Report

Testing for Extrasensory Perception With a Machine

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Abstract

Parapsychology, of which extrasensory perception (ESP) is a branch, is not transitory. Since reports of apparently significant ESP performances are increasing in number, it becomes more important to use the most rigorous of experimental techniques in testing the ESP hypothesis.

A design of a scientifically rigorous experiment in ESP is presented as an acceptable model for work in this field. This report covers the design of an objective test of three modes of ESP, pretest considerations and planning, final testing, and results obtained using the specially designed testing and recording machine, the VERITAC. Finally, a statistical analysis of the results and a discussion of statistical considerations are presented.

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Testing for Extrasensory Perception with a Machine

1. INTRODUCTION

Extrasensory perception is often discussed by laymen and scientists in emotional terms because the present research evidence pertaining to the existence, or non-existence, of psychical phenomena appears to be inconclusive. Consequently, ESP is a highly controversial subject, and one can quickly become embroiled in vigorous and fruitless argument with believers and non-believers alike, unless he is extremely careful in his discussion approach.

Perhaps ESP is more controversial than it warrants. Certainly, it offers no threat of any kind, and a definite requirement exists for testing its hypotheses. If the claims made for ESP are valid, a clear understanding of how and why it operates is essential because it would be a process of inestimable utility. On the other hand, if ESP claims could be conclusively disproven, many thousands of dollars and scientific man-hours could be saved.

Both the proponents and opponents of the ESP hypotheses maintain that they hold valid reasons for their positions. However, to give credence to apparent manifestations of ESP in its various forms, one must entertain the idea of some unknown force which often repels the physical scientist.

Many studies appear in the literature that make some extraordinary claims for the existence of certain kinds of ESP behaviors in certain kinds of people, and reports of significant performances are increasing. For various reasons many well

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designed experiments yielding negative results have not been reported or, at best, have received only slight mention.

Because there exist so many conflicting attitudes relating to ESP in general, the independent and emotionally unbiased investigator is forced to conclude that the ESP controversy has resulted in a stalemate – that neither side has conclusively proven its case to date.

Parapsychology, of which ESP is a branch, is not transitory. The subject is attracting the attention of an increasing number of respected scientists. With reports of significant ESP performances growing in number, it is apparent that the time is fast approaching when objective and emotionally unbiased scientists, using rigorous experimental techniques, must test the ESP hypotheses in order to make clear the nature of these phenomena to themselves, and to the public. Moreover, until a sizable segment of the orthodox scientific community displays the integrity and courage to conduct a series of appropriate experiments, and publishes both positive and negative results impartially, the ESP controversy will never be resolved.

With this conviction in mind, the authors converged on the problem of experimenting in ESP in order to: (1) test their own skills in experimental design by applying them to this little known area; (2) develop the knowledge which could lead to intelligent evaluations of existing studies and opinions in the field; (3) have first-hand ESP testing experience with subjects in a controlled environment; (4) gain experience in analyzing ESP type responses in a rigorous statistical fashion; (5) evaluate various data collection, data reduction, and statistical analysis techniques for application to ESP data.

This paper is not intended to give aid or comfort to either faction in the ESP controversy, but, rather, it is a straightforward report of an ESP experiment, the design of which is offered as an acceptable model for work in the field.

2. RESEARCH TEAM

The research team consisted of a psychologist, an electronics engineer, a physicist with a background in statistics, and a mathematician. Each of these disciplines were represented in the establishment of a rigorous experiment in ESP because possible weaknesses in applications of each field had been identified in the survey of the literature.

It was obvious that the psychological aspects of ESP testing must be accounted for, considered, and controlled in expert fashion. Thus, the psychologist was part of the team. In order to develop and implement the instrumentation required for stimulus control and automatic response recording, an electronics engineer adept at designing such systems was required. The statistical background and competence of the physicist was necessary because his knowledge relates to experimental design,

the statement of hypotheses in operational terms, and the analysis and interpretation of the data in the final phases of the research. The mathematician was required for collecting, organizing, and processing the data.

The team was compatible and worked together in formulating hypotheses, developing the experimental design, analyzing the data and reporting it. Interest in the experiment was intense and creative because each member of the team participated of his own volition. Consequently, the team effort resulted in the collection of more data and the exercise of more initiative than had been expected.

3. FIRST CONSIDERATIONS

A survey of the literature definitely disclosed that both the proponents and opponents of ESP had strong and telling arguments to support their views. It was obvious then that these arguments had to be taken into consideration when the experiment was designed.

Opponents of ESP, and even those who support the concept in varying degrees, emphasize that a repeatable experiment has never been designed in this field. This stand is justified from a physical sciences standpoint where repetition of experiments and consistency of results are mandatory, and historically have been achievable. If one can accept ESP as a bonafide phenomenon of nature, there should be no sound scientific reason why repeatability could not be obtained. It might be difficult, but not impossible.

Opponents of ESP often claim that experiments are not conducted in a sufficiently rigid manner so that all factors can be controlled. They insist that tight reins must be kept on experimental design, the manner in which stimuli are presented to the subject, the selection and control of subjects, and the capturing of responses which come from the experiment.

The existence of certain clues in the experimental environment, whether audio, visual, or other are frequently seen to be possible in many of the experimental designs that have been previously established. The use of human data recorders is also a real weakness from which many studies suffer. The possibilities of biasing the results, either for or against the hypotheses, or of making up fictitious results exist because of inadequate data recording controls in many of the previous experiments.

From the very outset of this project the investigators attempted to overcome these and many other deficiencies observed in the historical approaches to ESP research. There was no desire on the part of the investigators to evaluate the concept of ESP itself. It was recognized that a single experiment could not possibly lead to any conclusive evidence either for, or against, the existence of ESP phenomena. Consequently, the main effort was focused upon the design of an experiment which could be repeated by other researchers.

In the early stages of this project a paper by A. L. Kitselman (1961) influenced the research team in considering a completely automated system for conducting ESP experiments. Kitselman mentions that ESP work can be recorded, scored, and evaluated entirely by an electronic computer to obtain results free from human bias.

Kitselman's references to the use of a computer for ESP study are interesting and applicable. However, computers are generally unavailable for this type of work and are always expensive. Therefore, we decided to design and build a much less expensive, more mobile, special purpose machine capable of presenting stimuli randomly and automatically recording and scoring responses of subjects. The apparatus so designed and built was called the VERITAC.

4. APPARATUS

The VERITAC is an electronic and electro-mechanical system specifically designed to be used in conducting ESP experiments, and consists of:

1. The Control Section comprising:
   A. Control Console (Figure 1)
   B. Program Cabinet (Figure 2)
   C. Data Recording Equipment (Teletypewriter and Tape Reperforator, Figure 2)
   D. Reaction Time Recorder (Esterline Angus Recorder, Figure 2)
2. The Subject's Console (Figure 3)

When the system has been set up for making tests, all components of the Control Section are installed in one room while the Subject's Console is located in another room, an appreciable distance from the first. The two rooms are situated in such a way that the subject, while at his console, is unable to obtain any clues as to what is occurring or has occurred in the control room.

The key element of the VERITAC is a start-stop, push button operated Random Number Generator. Numbers 0 through 9 are generated at a rate of approximately 2500 per sec, and when the generator is stopped, the last number generated is displayed by a neon indicator mounted on the upper right front panel of the Control Console.

The VERITAC is used to measure the ability of a subject to correctly identify, in the absence of any clues, a series of randomly generated numbers. These numbers are presented as psi stimuli in selected modes of operation and the subject interacts with the VERITAC in prescribed ways. Responses of the subject are automatically timed, compared with the stimuli, scored, and recorded.

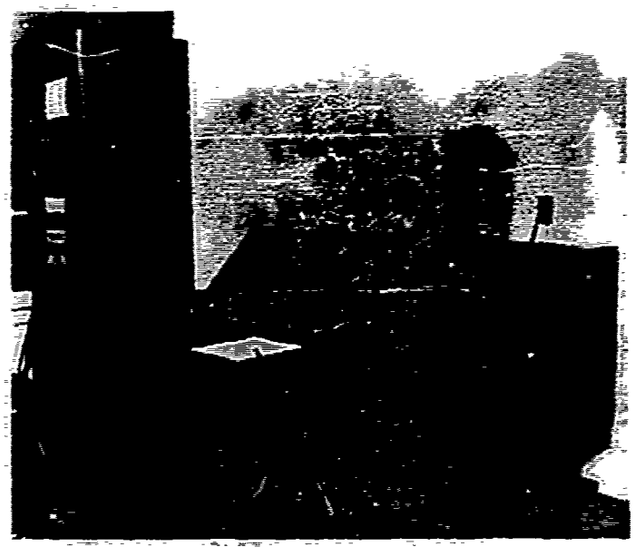

Figure 1

Figure 2

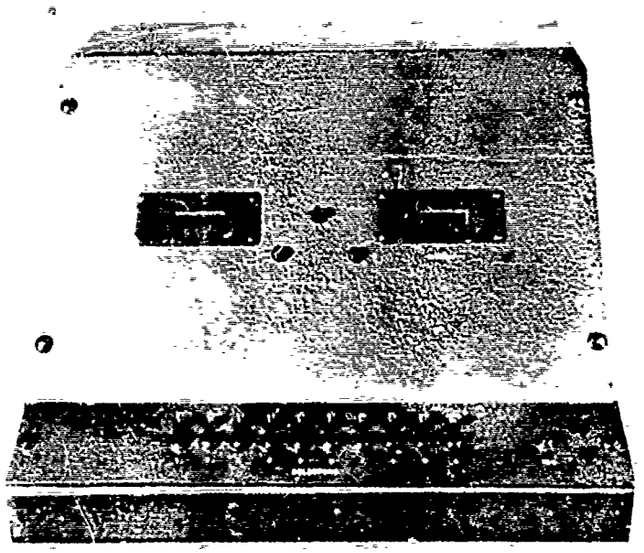

Figure 3

A subject is tested in the following three modes:

1. Clairvoyance: A condition requiring the subject to select the number which he believes has been generated. The subject starts and stops the Random Number Generator at his own discretion. The numbers, so generated, are presented as targets in the Control Console, but are not shown to the subject or to anyone else.

2. Precognition: A condition requiring the subject to select beforehand a number which he believes will be generated. The subject starts and stops the Random Number Generator at his own discretion. The numbers, so generated, are presented in the Control Console, but are not shown to the subject or to anyone else.

3. General Extrasensory Perception (GESP): A condition requiring the subject, acting as a percipient, to select the number which he believes has been generated. The numbers, so generated, are presented as targets in the Control Console, but are not shown to the subject. However, they are seen by one person who acts as a telepathic agent or sender. In this mode clairvoyance or telepathy, or both, may be operating.

Because of the high degree of automaticity provided by the VERITAC, a complete man-machine condition is obtained in clairvoyance and precognition tests. This is extremely advantageous since it effectively removes any biasing effects which could be introduced by the investigator or human data recorder. In GESP

tests an agent is introduced into the experimental environment, but his only functions are to observe and concentrate upon the generated targets (numbers).

Reference is made to the Basic Block Diagram of the VERITAC system (Figure 4). The Control Section components are shown above the dotted line, and the Subject's Console is shown below. Note that the Control Console consists of three units: Random Number Generator Unit; Selector and Comparator Unit; Data Processing Unit. Note in addition, that the remotely located Subject's Console is connected to the Control Console by a cable.

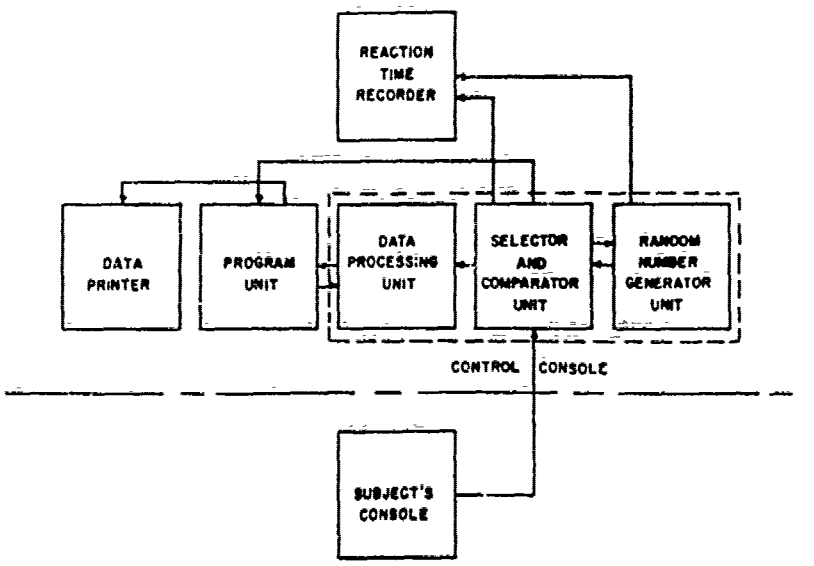

Figure 4

Recall that the subject attempts to select the number(s) which he believes has been, or will be, generated. By pushing the appropriate buttons on the lower panel of his console (Figure 5), the subject sets the generated number and his selected number into the machine. The generation of a number and the selection of a number constitute one 'trial sequence'. The order of number generation and selection is determined by the type of test being conducted. A switch in the Control Console pre-sets the VERITAC circuitry so that the system will not function until the proper trial sequence order has been completed.

Immediately after a trial sequence has been properly completed, the VERITAC goes into a 'locked' condition, and remains locked until the data in the machine have been printed out by the teletypewriter. While the VERITAC is in the locked condition, the subject can neither generate additional numbers nor change his selection.

Figure 5

Two electro-mechanical counters are mounted on the front panels of each console (Control and Subject's). One counter is labeled 'Trials' and the other is labeled 'Correct'. These counters provide a continuous tabulation of the number of trials and the number of correct selections made by the subject during a test. If it is desired to withhold this information from the subject, the counters in his console can be disconnected.

Mounted in the Program Cabinet is a digital clock which has been modified for the VERITAC system. The time indicated by the clock is recorded on the data record sheet for each trial sequence. An example of an actual data record sheet is shown in Figure 6.

The Reaction Time Recorder is an Esterline Angus single-pen recorder. By positioning the pen, the reference line is made to fall in the center of the chart. Directional changes in the current flow through the instrument will cause the pen to deflect to the right or left of the center line.

When connected to the VERITAC, the pen is deflected to the right when the Random Number Generator is turned on, and when the generator is turned off, the pen drops back toward the center line. When a number is selected, the pen deflects to the left and then returns toward the center line.

CONNIE THOMAS
FEB 15 1962
TEST NO 95
TEST TYPE C

TIME	SN	GN	TIME	SN	GN	TIME	SN	GN	TIME	SN	GN
1039	6	5	1039	8	0	1040	5	7	1040	5	2
1040	9	2	1040	2	9	1040	6	6	1040	0	9
1040	7	0	1040	3	2	1040	9	4	1040	1	2
1041	9	2	1041	7	5	1041	0	7	1041	6	4
1041	5	1	1041	8	6	1041	4	2	1041	8	0
1041	9	1	1041	3	4	1041	8	8	1042	5	4
1042	0	5	1042	2	9	1042	7	1	1042	0	2
1042	5	9	1042	8	6	1042	4	1	1042	8	8
1042	5	7	1042	9	9	1043	6	3	1043	7	6
1043	8	9	1043	3	6	1043	6	9	1043	2	2
1043	7	9	1043	1	6	1043	9	9	1043	4	6
1043	8	8	1044	6	7	1044	5	3	1044	7	3
1044	9	8	1044	5	9	1044	8	6	1044	6	8
1044	9	5	1044	2	2	1044	4	5	1044	7	4
1044	4	8	1045	8	5	1045	7	9	1045	5	1
1045	6	3	1045	3	3	1045	9	3	1045	6	5
1045	2	6	1045	9	9	1045	5	7	1045	3	8
1045	8	8	1046	6	2	1046	9	2	1046	4	9
1046	2	1	1046	9	6	1046	0	6	1046	4	0
1046	8	2	1046	3	8	1046	9	2	1046	5	4
1046	3	2	1046	9	4	1047	9	0	1047	0	8
1047	4	1	1047	3	5	1047	7	1	1047	9	5
1047	7	3	1047	5	9	1047	2	5	1047	6	0
1047	8	1	1047	2	3	1047	9	2	1048	5	1
1048	2	5	1048	9	1	1048	1	7	1048	7	1

SCORE 100/11

Figure 6

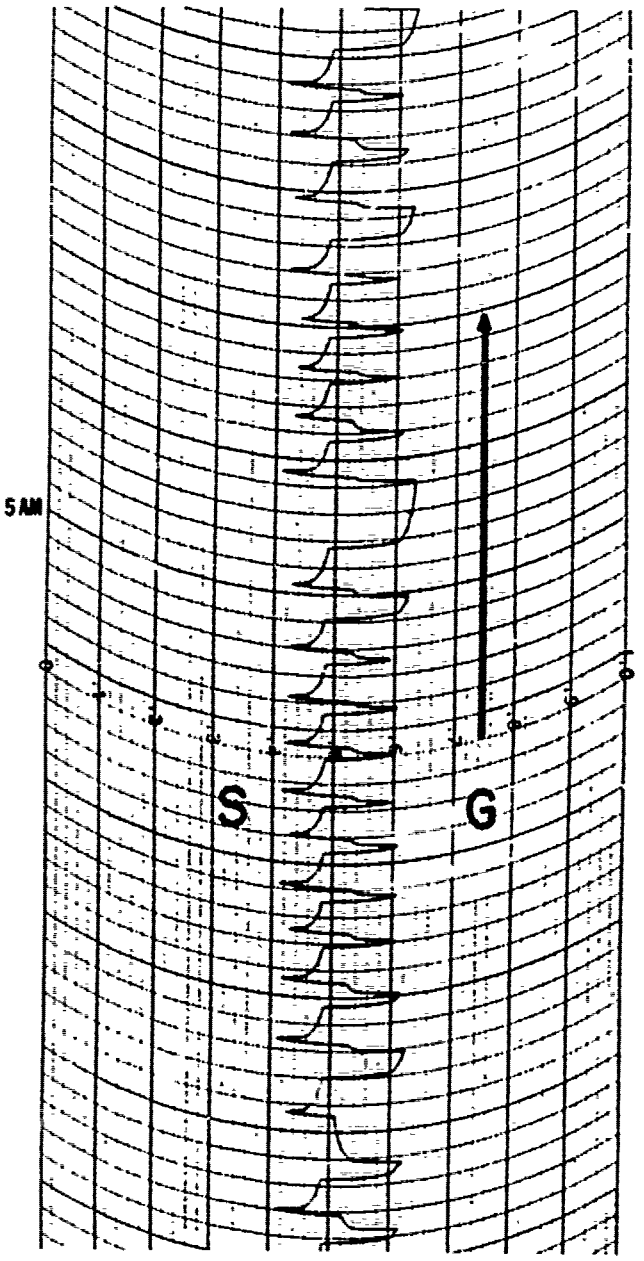

Figure 7

The recorder chart moves at the rate of 6 inches per minute, or 0.1 inch per second. The elapsed time between number generation and selection is measured from the time the needle starts to drop toward the center line (after the number has been generated) until it crosses the center line as the number is selected. A sample of an actual reaction time recording is shown in Figure 7. Measurement accuracy is exact to 1/2 sec and can be estimated to 1/4 second.

5. EXPERIMENTAL DESIGN

As soon as the VERITAC became available, it was checked for operational effectiveness and accuracy, and several pilot studies were run. These studies showed that the apparatus would perform as intended, that it was reliable in operation, and that the generated numbers met rigorous statistical criteria for randomness.

The experiment was then designed with the VERITAC as the key element. However, this was not a restriction because the machine had been designed to fulfill the basic requirements set forth in the early planning phases of the project.

Three types of psi were to be investigated: Clairvoyance, Precognition, and General Extrasensory Perception (GESP). For convenience, the test for Clairvoyance was titled Type C; for Precognition, Type P; and for GESP, Type G. Each subject was to complete five runs of each type, and each run was to comprise 100 trials. Therefore, each subject was to make 500 psi responses in order to complete a test series of one type, and 1500 psi responses to complete the test series of all three types.

In 1950, Margaret Knight wrote: "It is a waste of time to conduct further laborious experiments merely to demonstrate the occurrence of ESP. This has now been established beyond reasonable doubt. The aim of future experiments should be to elucidate the conditions of its occurrence, for in this way alone can we hope to explain its nature."

We agree with Knight that more than enough has been published which purports to present evidence for ESP. More important now would be good experimental evidence to explain the mechanism which makes ESP work. However, before the triggering mechanism can be identified, the phenomena must be observed.

If our experiment could uncover several subjects who apparently displayed ESP capabilities, their personalities might be similar. Certain personality traits, or profiles of traits, might be good clues in determining to a first approximation which type of people could best perform in an ESP situation. For the identification of personality traits, the Minnesota Multiphasic Personality Inventory was administered to all subjects during the experimental period.

A prime consideration in psi testing is the environment in which the tests are nducted. The criteria for a suitable environment were considered to be:

1. A pleasant, warm, and comfortable atmosphere as opposed to the cold rility of a laboratory.

2. It had to be a relatively secluded building, preferably somewhat remote m other physical structures and office activitie. , so that distracting influences l interruptions could be minimized.

3. Location of the testing rooms so that no interaction between the subjects l other individuals or the control equipment would be possible.

The criteria for the subjects comprising the experimental sample were estab- ned as follows:

1. From a statistical standpoint, it was desirable to have a sample of at least subjects. People who claim to be gifted, or are reputed to be gifted, with psi lity are difficult to find. Therefore, it became apparent that a sample of appro- ate size would have to be selected from a population which by most criteria would considered 'normal'.

2 Some authorities in parapsychology believe that the ESP process is often intuitive one. Additionally, women are sometimes believed to be more intuitive n men. Therefore, it was felt that our sample responses would be optimized if women were tested.

3. It was essential that the subjects be open, friendly, cooperative volunteers. h subjects initially would be highly motivated to make the experiment a success, their high degree of motivation could probably be sustained without too much iculty. Also it was felt this type of subject would be most apt to be receptive to ESP hypotheses.

PRETEST PLANNING

With the criteria for the testing environment and the experimental sample final- d, it was concluded that a group of college or junior college girls would be the opriate sample for experimentation. Appropriateness in this case related to lability as well as to composition of the sample, and the fact that the required ing environment could very probably be found on the school campus.

After considerable searching, Endicott Junior College in Beverly, Massachusetts, identified as an ideal place for the experimental trials. When the college of- ials were approached with the proposal that the experiment be conducted there, oval and full cooperation were immediately given.

Four classes were contacted by the experimenters, Dagle and Hill. A brief anation of psi phenomena, the reasons for the experiment and a short descrip- of the equipment were given to the girls in each class. Questions were invited

and answered, and when volunteers were requested, the response was most gratifying.

A short time later each volunteer was asked to meet with Dagle. A depth type interview was conducted in an effort to identify eight personal characteristics or attitudes which were originally hypothesized to relate to the experiment. Each person being interviewed was rated on a 10-point scale for:

1. Degree of understanding regarding the nature of the experiment
2. Degree of previous experiences thought to be ESP types (number and magnitude)
3. Degree of religiousness
4. Degree of talkativeness in the interview situation
5. Degree of relaxation in the interview situation
6. Degree of interest and enthusiasm in the experiment
7. Degree of flexibility and open-mindedness regarding the experiment
8. Degree of belief in the ESP hypotheses (Sheep-Goat classification).

The 'Sheep-Goat' evaluation involved an estimation by the interviewer of the degree to which each subject believed in ESP, and had an aggregation of personal characteristics which appeared to be either conducive or nonconducive to effective performance in the ESP situation. This rating stems from other research in ESP (Schmeidler and McConnell, 1958). In the 10-point rating system, those rated from 1 to 5 were termed 'Goats', while those rated from 6 to 10 were termed 'Sheep'.

The eight characteristics or attitudes evaluated in the interview were to be correlated with any differences in performance that were significant in the experiment to come. The interview was a nondirective, probing kind and it is estimated that highly reliable evaluations of the sample were obtained. A tabulation of the gradings is presented in Table 1.

7. TESTING

Actual testing began on 22 January 1962, and was continued every school day until 31 May 1962. Subjects were scheduled for tests at the most convenient times and as class schedules would permit. Subjects rarely failed to keep their appointments, and there was very little free time between test sessions. All tests were conducted by Dagle and Hill.

The testing rooms on the second floor of a small cottage were ideal, and the VERITAC was installed in such a way that no feedback or communication with the subject was possible once the test run had begun. Figure 8 shows the building in which the tests were run and Figure 9 illustrates the floor plan of testing rooms.

While the test was in progress, the doors to the subject's room and the control room were tightly closed. During Type C and Type P tests, both experimenters remained in the office. During Type G tests one experimenter acted as the agent at the Control Console (Figure 10), while the other remained in the office.

Figure 8

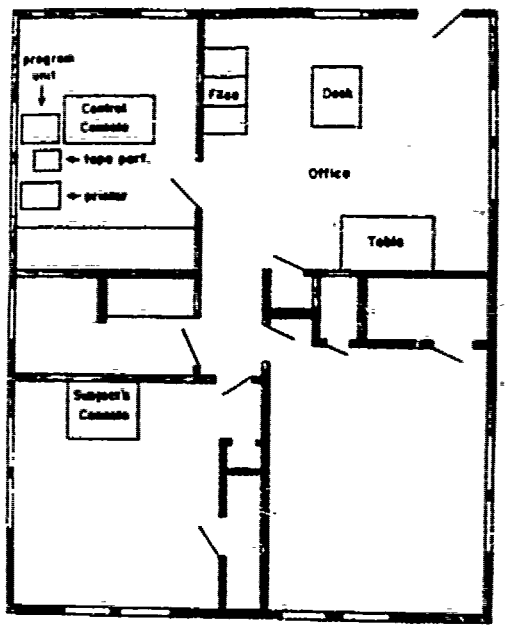

Figure 9

Figure 10

Initially, 45 subjects were enrolled for the experiment. From this number, 37 subjects completed the entire series of tests. The attrition rate of only 8 subjects indicates that the high degree of motivation was sustained throughout the entire testing period. Of the 8 drop-outs, 4 were due to illness, 2 to academic difficulties, and 2 to loss of interest.

8. RESULTS

Each subject retained in the final sample completed 5 runs of 100 trials each in each experimental mode. This resulted in a total of 1,500 psi phenomena responses for each subject, or 55,500 psi phenomena responses for the total group. Scores for each subject and for the group were analyzed by appropriately rigorous statistical methods. Tabulations of the scores are contained in Table 2.

It is conventional to calculate the statistical probabilities of chance factors alone being responsible for the scores obtained in ESP experiments. Parapsychologists, in general, have established a probability level of 0.01 as the criterion of significance, and in our evaluations we have held to this convention.

A summary of our evaluations is presented herewith:

I. For the Overall Experiment

Hits. For the 1,500 responses of a single subject in the entire experiment, the expected hit score is 150 since for each trial, there is 1 chance in 10 of making a hit. The binomial probability of obtaining 172 or more hits is less than 0.01. Two subjects (Nos. 6 and 8) obtained scores of 173, a deviation of +23 from the expected score. It is interesting to note that one subject (No. 4) obtained a score of only 121, a deviation of -29 from the expected score.

Chi Square Test of Significance for the Group. A Chi Square test of significance was applied to the total scores obtained by the group. A Chi Square value with 37 degrees of freedom, greater than 73.2 was required for significance (probability less than 0.01). The Chi Square value obtained in this test was 33.8296 (p=0.3751).

Chi Square Test of Significance for Each Subject. Fifteen runs of 100 trials each were made by each subject. The expected score for each run was 10. A Chi Square test with 15 degrees of freedom was applied to each subject's scores. For significance a Chi Square value equal to or greater than 30.578 was required. In no case was this value obtained.

Hit Totals. For the 55,500 responses made by the group in the entire experiment, the expected number of hits was 5,500. The total number of hits obtained by the group was 5,567, a deviation of only +67 from the expected score.

II. For Type C Tests

Hits. For the 500 responses of a single subject in Type C tests, the expected hit score was 50. The binomial probability of obtaining at least 67 or more hits is less than 0.01. No subject obtained a hit score greater than 64.

Hit Totals. For the 18,500 responses of the entire group in Type C tests, the expected hit score was 1,850. The total hit score obtained was 1911, a deviation of +61 from the expected score.

Chi Square Test of Significance for the Group. A Chi Square test of significance with 37 degrees of freedom was applied to the series scores obtained by the group in Type C tests. A Chi Square value of 73.2 was required for significance (p=0.01). The Chi Square value obtained in this test was 38.733 (p=0.3936).

Chi Square Test of Significance for Each Subject. A Chi Square test of significance with 5 degrees of freedom was applied to the run scores of each subject. A Chi Square value of 15.086 was required for significance. In no case was a value this great obtained in Type C tests.

III. For Type P Tests

Hits. For the 500 responses of a single subject in Type P tests, the expected hit score is 50. The binomial probability of obtaining 67 or more hits is less than 0.01. No subject obtained a hit score greater than 64.

Hit Totals. For the 18,500 responses of the entire group in Type P tests, the expected total hit score is 1,850. The total hit score obtained was 1,870, a deviation of +20 from the expected score.

Chi Square Test of Significance for the Group. A Chi Square test of significance with 37 degrees of freedom was applied to the series scores obtained by the group in the Type P tests. A Chi Square value equal to or greater than 73.2 was required for significance ($p = 0.01$). The Chi Square value obtained in this test was 31.733 ($p = 0.2820$).

Chi Square Test of Significance for Each Subject. A Chi Square test of significance with 5 degrees of freedom was applied to the run scores of each subject. A Chi Square value of 15.086 was required for significance ($p=0.01$). One subject (No. 6) had a Chi Square value of 17.556 ($p = 0.095$).

IV. For Type G Tests

Hits. For the 500 responses of a single subject in Type G tests, the expected hit score is 50. The binomial probability of obtaining 67 or more hits is less than 0.01. No subject obtained a hit score greater than 64.

Hit Totals. For the 18,500 responses of the entire group in Type G tests, the expected total hit score was 1,850. The total hit score was 1786, a deviation of -64 from the expected score.

Chi Square Test of Significance for the Group. A Chi Square test of significance with 37 degrees of freedom was applied to the series scores obtained by the group in Type G tests. A Chi Square value of 73.2 was required for significance ($p = 0.01$). The Chi Square value obtained in this test was 52.622 ($p = 0.0432$).

Chi Square Test of Significance for Each Subject. A Chi Square test of significance with 5 degrees of freedom was applied to the run scores of each subject. A Chi Square value of 15.086 was required for significance ($p=0.01$). One subject (No. 1) obtained a Chi Square value of 15.333 ($p = 0.01$).

V. Chi Square Test for Goodness of Fit.

The individual run scores for each type of test were grouped in classes according to their frequency of occurrence (how many times was a score of 5, 6, 7, 8... 12 and so forth obtained), and a Chi Square test for Goodness of Fit was applied to each type of test. The Chi Square values and probabilities obtained are as follows:

Type C: Chi Square = 14.099; $p = 0.2951$
Type P: Chi Square = 9.0095; $p = 0.5394$
Type G: Chi Square = 14.124; $p = 0.2937$

A probability value of 0.01 was required for significance.

VI. Analysis According to Sheep-Goat Classification.

Referring to our Sheep-Goat determination obtained from the depth interviews of the volunteers, we found that our sample of 37 consisted of 18 Sheep and 19 Goats.

An analysis of the results obtained by each group resulted in the following:

SHEEP

18 Subjects

Hit Totals. For the 9000 responses of the entire group in each type of test, the expected total hit score was 900. The total hit score and the deviation from the expected score for each type is:

Type C: 938; Dev. +38
Type P: 911; Dev. +11
Type G: 865; Dev. -35

Chi Square Test of Significance for the Group. A Chi Square test of significance with 18 degrees of freedom was applied to the series scores obtained by the group in each type of test. A Chi Square value of 34.805 was required for significance ($p = 0.01$). The following were obtained:

Type C: Chi Square = 24.844; $p = 0.1355$
Type P: Chi Square = 11.133; $p = 0.8865$
Type G: Chi Square = 35.933; $p = 0.00865$

GOATS

19 Subjects

Hit Totals. For the 9,500 responses of the entire group in each type of test, the expected total hit score was 950. The total hit score and the deviation from the expected score for each type is:

Type C: 973; Dev. +23
Type P: 959; Dev. + 9
Type G: 921; Dev. -29

Chi Square Test of Significance for the Group. A Chi Square test of significance with 19 degrees of freedom was applied to the series scores obtained by the group in each type of test. A Chi Square value of 36.191 was required for significance ($p = 0.01$). The following were obtained:

Type C: Chi Square = 13.889; $p = 0.7894$
Type P: Chi Square = 20.600; $p = 0.3650$
Type G: Chi Square = 16.689; $p = 0.6104$

9. DISCUSSION

The original intent of this section was to interpret the statistics. However, since no extra-chance effects were shown, it would be futile to do so. Nevertheless, the experiment has shown that certain characteristics of probabilistic research may lead to inaccurate interpretations of experiments in decision-making, guessing, communications, and ESP.

The first possibility for interpretive errors involves the use of the word 'significant'. It is conventional in probabilistic experiments to report as 'significant'

those results which allow rejection of the null hypothesis at a pre-selected level, for example .01, which is typical for ESP research. The word 'significant' in this context means only that it is probable that non-chance effects are at work. But it does not mean that chance is definitely inoperative or that a non-chance independent variable, or agent, has been isolated. Some careless readers might even interpret a finding which is significant at the .01 level as showing that the chances are 100 to 1 that a non-chance agent was operative. This inference is unjustified, for if a probabilistic experiment were repeated 1000 times, 10 of the results could show 'significant' results by chance alone. To carry the logic one step further, it appears as though 1/100 of all ESP experiments that have ever been conducted have exhibited 'significance'. However, this would be expected according to probability laws.

An example of the difficulty of interpreting an experiment whose sole description is in terms of acceptance or rejection of the null hypothesis may be found from our own data. The scores of the most promising subjects, Sheep, were separated from the scores of the least promising subjects, Goats. In the GESP test for Sheep, a significant group χ^2 value was found based on the null hypothesis; the probability of the hit is 1/10th, which would have been exceeded by chance with a likelihood of .0069. One may be tempted to accept this as a truly significant result because theoretically, Sheep are supposed to score more non-chance than Goats, and here a 100 to 1 possibility is demonstrated. We can cut the odds down immediately from 100 to 1 to 16 to 1 by observing that three tests were applied to both Sheep and Goats so that we have six χ^2 values. Furthermore, when the non-chance result is attributed to the fact that this is the Sheep group, it is a particularly empty form of second guessing unless one predicted this would happen and had a model for testing this hypothesis. Two principle causes could have made our χ^2 value too high. One is that the average hit probability for the group was either higher or lower than 1/10 but the distribution was still a binomial one. The other is that some people were guessing with a higher probability in the group, while others with a lower probability, the mean of the group being unchanged, but the variance of the distribution being thus increased. Prior to running the experiment, we had no means of dividing up the Sheep into plus and minus Sheep you might call them, so our alternative hypothesis was that the mean of the whole group would be shifted either up or down. Calculation of the χ^2 based on this assumption gives a new significance value of .0074 as opposed to .0069 with the null hypothesis. The implication is that presuming our alternative hypothesis is the appropriate one, our results are, nevertheless, due to chance.

Another logical error in ESP experiments, in particular, is introduced by the lack of rigor in setting statistical criteria for selecting designs for repeatability; and for selecting promising subjects for continuous, intensive research. In this

role, the null hypothesis test is used to discriminate between two classes of result; one, the majority, which is clearly chance; and the other, only a small percentage, which may be due to non-chance factors. This process, if correctly implemented, is desirable and may be the best technique for ultimately testing ESP phenomena. Even if it is assumed that ESP is a real, albeit illusive phenomenon, this method, to be effective, must be used with a full knowledge of the dramatic effects that the statistical criteria impose upon the selection process. For this method to be effective, the significance level must be carefully chosen in relation to the probability that a non-chance phenomenon may operate in a given experiment.

For example, suppose that ESP operates in 1/1000th of all such experiments. Then of those experiments which show 'significant' results at the .01 level, 9 out of 10 will be due to chance, and only 1 in 10 will be due to the extra chance factor. A model designed on the basis of the ten 'significant' experiments will be weighted 90 percent on the basis of chance results. If a significance level of .0001 is demanded for the prototypes, the final model would be weighted only 10 percent on the basis of chance results and 90 percent on the basis of the non-chance findings. The percentages would be reversed by changing the demanded level of significance from .01 to .0001 if the assumption were made that 1/1000 of the experiments showed true results.

At first the manipulation of the significance level may appear strange and somehow wrong. However, if a non-chance cause is operating in a particular experiment, there is no reason in principle why we cannot demonstrate it at any significance level no matter how small. In fact, the ability to do this is at the heart of the probabilistic interpretation of the experiment. The principal effect of choosing a very small significance level is that the experiment must consist of a great many trials so that the result will be suitably discriminated from a possible chance result. If a significance level of, for instance, one millionth is used, a great many results are ascribed to chance, and sufficient trials must be taken to insure that the non-chance result will be less likely still. Minor irritations may also arise when dealing with small significance levels; such as, the inadequate ranges existing in prepared tables, and the need to verify that approximate distribution functions are still applicable. However, these are details which have nothing to do with the principle of the matter.

It is apparent, therefore, that this procedure will lead to very long test runs. Parapsychologists often appear to avoid long test runs on grounds that the ESP ability may be impaired. This may or may not be true, but it is not a statistical argument against long runs. An experimenter may develop his subjects in any way he chooses and when he considers them to be ready may start his trial runs for record. As long as the run length (short or long) and the number of runs are predetermined, any amount of meaningful data can be obtained in this manner.

In summary, it seems important in ESP and other probabilistic experiments to insist that a significance level be selected that is considerably smaller than the frequency of the hypothesized occurrence of ESP in the experiment. Also, long trials and many experiments are required in order to satisfactorily distinguish ESP from chance when it does occur, and many experiments are required to get a significant sample of significant experiments.

By implication, it becomes important to make public all outcomes of experiments whether they are 'significant' or 'not significant' so that the entire sample can be viewed in truly probabilistic terms. To evaluate a phenomenon by considering only the significant experiments is a risky method in probabilistic experiments. By following these recommendations a repeatable experiment in ESP may be developed and the extensive correlates which are eagerly sought should be stable in regard to their significant ESP behaviors.

TABLE 1. Tabulation of depth interview scores

Subject No.	ITEM[a] 1	2	3	4	5	6	7	8
1	3	1	5	4	4	6	6	5
2	3	2	5	5	6	6	6	5
3	4	3	4	7	7	7	6	6
4	5	4	4	5	6	7	6	6
5	3	2	4	6	6	6	5	4
6	5	1	4	7	7	8	7	5
7	3	4	5	5	6	6	7	6
8	3	4	6	5	7	6	6	6
9	3	2	6	6	6	5	5	6
10	3	3	5	5	5	7	7	5
11	3	7	7	6	7	8	8	8
12	3	6	5	6	6	7	7	6
13	3	2	4	5	5	5	6	5
14	4	4	4	5	6	7	7	6
15	4	3	4	6	6	7	7	6
16	3	3	4	6	6	7	7	7
17	4	2	6	6	7	7	6	6
18	3	2	7	6	5	6	6	5
19	3	2	4	5	6	6	6	5
20	3	3	4	5	5	5	6	5
21	4	2	7	6	6	6	4	4
22	4	3	4	6	6	5	4	2
23	3	3	2	5	6	6	6	6
24	3	2	3	6	7	7	7	7
25	3	1	4	5	5	6	6	4
26	5	3	4	6	6	7	7	5
27	3	6	4	7	7	8	8	8
28	5	2	4	6	6	6	7	3
29	4	6	7	6	6	7	7	7
30	3	3	5	5	5	6	6	6
31	3	3	2	4	4	6	6	6
32	2	3	5	6	6	6	6	5
33	3	1	5	6	6	7	7	5
34	2	2	7	4	4	5	3	3
35	3	3	5	6	6	7	7	6
36	3	3	5	6	6	7	6	5
37	4	2	5	5	6	5	6	5

[a] ITEMS:

1. Degree of understanding regarding nature of experiment.
2. Degree of ESP experiences (number and magnitude).
3. Degree of religiousness.
4. Degree of talkativeness in the interview situation.
5. Degree of relaxation in the interview situation.
6. Degree of interest and enthusiasm in the experiment.
7. Degree of flexibility and open-mindedness regarding experiment.
8. Degree of belief in the ESP hypotheses (Sheep-Goat classification).

TABLE 2. Scores of 37 subjects completing 15 tests of 100 trials each

Subject No.	TYPE C						TYPE P						TYPE G						Overall Total
	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	
1	19	14	10	10	11	64	9	6	7	13	8	43	14	5	16	5	16	56	163
2	11	11	12	9	11	54	8	18	7	7	17	57	10	14	8	4	8	44	155
3	14	9	9	7	12	51	11	4	6	8	9	38	8	15	13	12	7	55	144
4	6	9	4	10	5	34	5	12	8	10	9	44	11	6	5	9	12	44	121
5	14	8	13	7	7	49	15	8	11	9	9	52	9	14	5	10	11	49	150
6	5	12	12	11	8	48	6	9	14	20	15	64	11	11	11	16	12	61	173
7	12	10	9	10	9	50	9	12	10	14	13	58	6	6	10	9	11	42	150
8	13	11	9	10	14	57	15	11	11	7	8	52	12	10	11	13	18	64	173
9	8	17	13	11	13	62	7	8	8	12	13	48	11	5	6	8	11	41	151
10	10	9	9	9	12	49	11	8	12	9	15	55	11	15	8	11	5	50	154
11	10	13	13	7	9	52	4	4	13	13	8	42	14	7	7	7	9	44	138
12	10	11	14	10	16	61	10	15	12	7	13	57	13	8	7	5	4	37	155
13	10	10	6	11	11	48	11	14	7	14	8	54	13	14	9	15	8	59	161
14	9	11	11	10	16	57	11	13	8	8	8	48	13	18	8	13	11	63	168
15	11	8	13	10	14	56	9	8	12	11	14	54	8	6	9	7	4	34	144
16	14	10	11	7	13	55	13	13	10	10	11	57	9	10	8	10	9	46	158
17	7	15	13	9	12	56	12	7	11	10	11	51	6	11	16	7	7	47	154
18	14	12	8	9	10	53	9	14	17	10	13	63	7	8	7	10	7	39	155
19	12	9	8	8	9	46	5	9	7	12	10	43	8	8	12	11	14	53	142
20	10	10	13	11	10	54	5	5	12	13	9	44	9	11	8	9	6	43	141
21	8	5	13	10	13	49	10	15	9	8	12	54	7	14	11	7	7	46	149
22	10	6	17	9	12	54	8	9	9	15	7	48	8	16	9	6	9	48	150
23	7	12	8	10	4	41	10	7	11	11	11	50	6	12	13	6	7	44	135
24	7	9	10	8	10	44	12	8	7	9	14	50	9	14	7	5	13	48	142
25	18	12	9	13	5	57	8	13	7	12	8	48	6	7	12	10	8	43	148
26	10	12	9	13	9	53	7	7	10	5	9	38	7	11	7	9	5	39	130
27	1.	21	10	10	7	60	11	11	11	12	9	54	7	7	2	9	10	35	149
28	11	12	10	10	5	48	7	7	10	10	8	42	6	11	13	10	8	48	138
29	8	6	8	10	10	42	11	13	11	10	11	56	11	13	10	10	15	59	157
30	10	14	10	16	6	56	4	9	16	9	13	51	4	10	13	5	14	46	153
31	11	10	10	15	12	58	14	13	4	12	5	48	8	17	15	11	12	63	169
32	5	11	16	13	13	58	9	7	8	12	11	47	8	10	13	6	5	42	147
33	13	12	8	9	11	53	11	13	15	10	9	58	11	9	8	7	10	45	156
34	10	12	11	6	6	45	11	7	11	11	14	54	9	8	12	15	9	53	152

TABLE 2. (Contd)

Subject No.	TYPE C						TYPE P						TYPE G						Overall Total
	1	2	3	4	5	Total	1	2	3	4	5	Total	1	2	3	4	5	Total	
35	12	8	9	9	8	46	14	10	10	10	9	53	12	11	16	10	5	54	153
36	16	8	14	7	9	54	9	9	10	11	8	47	8	9	8	12	15	52	153
37	2	8	13	4	10	37	8	9	14	9	8	48	13	9	10	12	7	51	136
				Total		1911				Total		1870				Total		1786	5567

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Glossary

Parapsychology, like other specialized fields, has its own unique vocabulary and idioms. For those unfamiliar with this language, the following glossary has been extracted from Parapsychology, The Frontier Science by J. B. Rhine and J. G. Pratt.

Agent: Sender in tests for telepathy, the person whose mental states are to be apprehended by the percipient. In GESP tests, the person who looks at the stimulus object.

Average Score: Average number of hits per run.

Call: The ESP symbol selected by the subject in trying to identify a target.

Chance Expectation = Mean Chance Expectation: The most likely score if only chance variation is present.

Clairvoyance: Extrasensory perception of objective events as distinguished from telepathic perception of the mental state of another person.

Deviation: The amount an observed number of hits or an average score varies from the mean chance expectation or chance average. A deviation may be a total (for a series of runs) or average (per run).

Displacement: ESP responses to targets other than those for which the calls were intended.

ESP: (Extrasensory Perception): Awareness of or response to an external event or influence not apprehended by sensory means.

Extrachance: Not due to charce alone.

GESP (General Extrasensory Perception): A technique designed to test the occurrence of extrasensory perception, permitting either telepathy or clairvoyance or both to operate.

P (Probability): A mathematical estimate of the expected relative frequency of a given event if chance alone were operative.

Parapsychology: A division of psychology dealing with behavioral or personal effects that are demonstrably nonphysical (that is, which do not fall within the scope of physical principles).

Percipient = Subject: The person who makes the calls in an ESP test.

Precognition: Cognition of a future event which could not be known through rational inference.

Psi: A general term to identify personal factors or processes which are nonphysical in nature. It approximates the popular use of the word 'psychic' and the technical one 'parapsychical.'

Psi Phenomena: Occurrences which result from the operation of psi ... (for example, ESP phenomena).

Run: A group of trials.

Score: The number of hits made in one run.

Total Score: Total of scores made in a given number of runs.

Series: Several runs or experimental sessions that are grouped in accordance with a stated principle.

Session: A unit of an ESP experiment comprising all the trials of one test occasion.

Significance: A numerical result is significant when it equals or surpasses some criterion of degree of chance improbability. The criterion commonly used in parapsychology today is a probability value of .01 or less.

Subject: The person who is experimented upon. In ESP tests, most commonly the percipient (though also the agent in GESP and telepathy).

Target: In clairvoyance or precognition tests the stimulus object; in telepathy, the mental state of the agent.

Telepathy: Extrasensory perception of the mental activities of another person.

Trial: In ESP tests, a single attempt to identify a stimulus object.

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